

Developing an Outcomes Infrastructure for Nursing

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An infrastructure to support the evaluation of patient care sensitive to the intervention of nursing personnel is being developed within a major health maintenance organization. In addition to traditional administrative measures of care, the database infrastructure will include measures of the patient's functional status, knowledge and engagement in care and psychosocial well-being. These measures are believed to be particularly sensitive to the independent intervention of the nurse. Reported here are the structures in place to monitor and support the reliability and validity of the administrative data elements; algorithm elements created to account for missing data; the model for the first generation of successful practice reports and the results of a study establishing the content validity of the clinical data elements.

INTRODUCTION

The major issues compelling the development of outcomes analysis within nursing are the drive towards professionalism and the economic factors impacting health care today.¹ In today's rapidly changing health care environment, efforts at cost containment are focusing on the shifting of care to less costly and less skilled providers and to less costly settings.² At the same time, nursing is seeking to define its accountability to the public for our practice³ by demonstrating the value of nursing care in terms of improved outcomes linked to specific nursing activities or interventions.¹ It is essential to be able to document the impact of these shifts on patient outcomes. The nursing leaders within the Kaiser Permanente Medical Care Plan, Northern California Region (KPNCR) acknowledge that controlling the cost and quality of nursing care can not be effectively accomplished without an infrastructure through which critical information relating to patient care and the outcomes of that care are routinely collected and available for analysis. For this reason, the KPNCR nursing leadership has identified as a strategic priority, the creation of an outcomes infrastructure through which the analysis of patient care via interventions and outcomes can be accomplished.

FOUNDATIONS OF THE DATABASE

Overview

The current KPNCR Nursing Utilization Database (NUD) integrates data from a workload measurement system, a computer based staffing and scheduling system and the admission, discharge and transfer (ADT) system to cost out hospital based nursing services. Aggregate population data allows the cost effectiveness of nursing resources to be evaluated in terms of dollars, skill mix, nursing ratio, length of stay and type of patient care unit.

Setting

The KPNCR is the largest health maintenance organization (HMO) in Northern California, serving more than 2.4 million members. Comprehensive health care is provided through a partnership between the Kaiser Foundation Health Plan, Kaiser Foundation Hospitals and The Permanente Medical Group, a practicing physician group. Acute, chronic and health maintenance services are provided at 26 medical offices and 16 acute care facilities ranging in size from 100 to 300 beds. Nursing care is provided in the hospitals, in the medical offices and in the home.

Patient Care Hours

Patient care hours (PCH) are the cornerstone of the NUD as they are a patient specific prediction of the nursing care required during the succeeding 24 hours. PCHs are derived from a workload measurement system and driven by physician and nursing orders. Approximately 70,000 patient linked interventions resulting in PCH values are entered per day into the data base. PCH data are derived from a mainframe based program linked to the ADT system and to the patient's unique member number. Each patient care unit establishes the fiscal alignment and clinical validity of its PCH instrument on an annual basis. Clinical validity is demonstrated by staff nurse review of the line items of the instrument as well as the comparison between the hours of care projected by the instrument and the hours of care the nurses indicate were actually needed to complete all required care. In addition, each patient care unit is required to maintain a standard of 90% agreement interrater reliability (IRR) on a monthly basis.

The unit manager implements a corrective action plan for any month during which the average IRR falls below 90%. At four week intervals, the facility coordinator documents compliance to PCH data quality standards at the unit level. Data collected during periods in which at least one data quality standard was missed is "flagged" on the mainframe. Average PCH per day and per stay values are determined using a weighting methodology which considers the proportion of time in each unit during a shift.⁴

Nursing Care Hours

The nursing care hours (NCH) by skill mix, on each unit, day and shift, are collected in a personal computer based staffing and scheduling software program. Each payperiod, NCHs are verified by reconciliation with time cards to the 0.1 hour level of accuracy. NCHs are linked to patients on the given unit, day and shift via the ADT system and assigned to individual patients based on their relative PCH weight.

Nursing Hospital-Based Cost Per Stay

Costs per stay are derived from individual patient PCH and NCH data aggregated at the diagnosis related group (DRG) level. In reports comparing facility performance, actual costs are adjusted to reflect differences in wage rates, levels of seniority and other sources of variance in payroll costs throughout the region. Nursing costs are reported on a quarterly and year-to-date basis through NUD reports.

Severity of Illness

A vender supported software program is used to adjust for the relative severity of illness of defined populations cared for within each facility⁵. The program was designed to predict resource utilization (based on length of stay and charges) for clinically related groups with relative severity based on the presence of ranked classes of secondary diagnoses.

Missing Data Algorithm

Complete data is essential for both cost-per-case analysis and for the development of equitable allocation models. Dropping cases with missing data from the analysis created a significant bias away from the more severely ill or resource intensive cases. This is because there is an increased probability that data from at least one shift would be missing during cases with longer lengths of stay. Table 1 provides an example of differences in mean lengths of stay (ALOS) for complete and incomplete cases. To account for this bias, it became essential to develop a methodology to "fill" missing data.

The Medical Economics and Statistics Department (ME&S) worked with nursing to develop fill algorithms

which made clinical and statistical sense. Definitions for maximum percent of shifts which could be filled (10%); the first priority fill value (PCH from previous shift); the second priority fill value (default value for the unit); and the standard for minimum percent of cases with complete PCH and NCH data (95%). Reports reflecting quality standards were developed and placed into production to enable each facility to monitor their data's quality.

Table 1. Comparisons of Lengths of Stay for One Facility: Complete and Incomplete Cases in the NUD

DRG	# Cases	% Cases Complete	ALOS ^a All Cases	ALOS Complete Cases	ALOS Incomp ^f Cases
140 ^b	130	99.2	2.2	2.2	5.0
209 ^c	118	97.5	8.1	7.9	15.0
127 ^d	181	93.4	4.8	4.5	8.4
All ^e	6,252	92.0	4.9	4.5	10.3

^a Average length of stay in days; ^b Angina; ^c Major Joint and Limb Reattachment Procedures; ^d Heart Failure and Shock; ^e All nonobstetric cases during 7 months in 1992; ^f incomplete.

Nursing personnel across the region were concerned about the ability of the NUD to reflect the practice of patient care in their facilities. Individual patient interrater reliability studies could fall significantly below 90% with resulting PCH values falling both above and below the true value. Knowing this, it was important to demonstrate that aggregate data at the population level would reflect the actual practice of patient care for the population in the facility. To address this concern, each facility reviewed aggregate data for the top 20 nonobstetric DRGs and top 20 obstetric DRGs. Data included average PCH and NCH per day, average PCH per day of stay, average PCH and NCH per stay, average PCH per day by unit type (e.g., intensive care, medical/surgical), average skill mix, ALOS, and total number of cases. Clear written descriptions of the data sources, definitions, calculations and quality issues were provided with the reports. Personnel were also asked to rank the DRGs in terms of those requiring the greatest to the least amount of nursing resources. The rankings based on database information were compared for equivalency with the rankings based on clinical experience.

Nursing, physician, utilization and health information personnel met in each facility to evaluate the NUD data. Except in those facilities with documented PCH and NCH data quality issues, the facilities reported that the

NUD accurately reflected both the care delivery patterns and the relative severity of illness (in terms of nursing resources required) for the population. It was reassuring that facilities with known data quality issues reported that the NUD PCH and NCH data did not consistently reflect practice. The one area of concern identified by most facilities was perceived discrepancies in the number of cases within each DRG. This consistent response helped to establish and prioritize efforts to evaluate the quality of medical records coding throughout the region.

Benchmarking for Successful Practice

Defining Successful Practice

The KPNCR hospital leadership commissioned a set of reports which would assist the medical centers in identifying methods through which cost savings could be obtained. The nursing chapter was developed from the NUD. Fifteen DRGs were selected for study based on their potential for improved utilization management and an additional 15 selected based on their cost.

Each DRG was evaluated for cost per discharge, discharge rate and evaluation of practice patterns within the three lowest cost facilities. If three facilities did not account for at least 15% of the region's discharges, a fourth facility was included. Facilities with fewer than 14 cases for a given DRG were also excluded from that DRG's analysis. Hospital nursing costs for each facility were adjusted for severity of illness and for wage rates. Stepwise regression techniques were combined with 'what if' analysis to determine the proportion of potential savings due to skill mix, nursing ratio, unit mix (e.g., patient days in intensive care, step down, medical/surgical units) and length of stay.

The Successful Practice reports reflect the costs of unit based nursing personnel involved in the support and the delivery of patient care. The reports are not intended to function as "report cards" for facility performance. Outcomes are not addressed and the costs for the entire health care event (e.g., supplies, home health and medical office follow-up) are not included. Instead, the reports help the facilities to focus, prioritize and document their efforts in evaluating patient care structures and processes.

Table 2 provides some of the major conclusions from the first set of Successful Practice reports. A potential savings of \$5,700,000 could be achieved through management of the 15 DRGs targeted for utilization management. ALOS held the greatest potential for cost savings for the 15 DRGs followed by the control of patient placement within the hospital (unit mix), nursing ratio and skill mix. This compared with \$7,500,000 in potential savings from the 15 high cost DRGs. For these

DRGs, ALOS also accounted for the greatest potential savings followed by nursing ratio, unit mix and skill mix.

Table 2. Summary of Results:
Sources of Potential Savings in Nursing Costs in
DRG^a Clusters Targeted for Management^b

15 DRGs Targeted for Utilization Management
\$5,700,000 - Potential savings in nursing costs
41% - Length of Stay
28% - Unit Mix
26% - Nursing Ratio
5% - Skill Mix

15 DRGs Targeted for High Cost
\$7,500,000 - Potential savings in nursing costs
45% - Length of Stay
16% - Unit Mix
35% - Nursing Ratio
4% - Skill Mix

Top six Utilization Management DRG clusters represent 62% (19,042) of the total number of discharges for the 15 DRG clusters (30,860), and 71% of the potential savings (\$4,000,000).

Angina, chest pain
Specific cerebrovascular disorders
Heart failure and shock
Stomach, esophageal & duodenal procedures
Simple pneumonia and pleurisy
Major joint and limb reattachment

^aDRG - Diagnosis Related Groups

^bData from October, 1992 - September, 1993

Moving From Successful to Best Practices

The Need for an Outcomes Infrastructure

Cost was the key criteria for Successful Practice analysis. While a valuable tool for directing utilization and resource management efforts, the Successful Practice reports could not address the essential question of whether the care provided resulted in improved health related outcomes for the patients. Recognizing the critical need to address this question, the nursing executives established the Outcomes Task Force for the purposes of developing a methodology through which patient outcomes sensitive to nursing care could be monitored and evaluated. This was an especially challenging goal as tools are not currently available which measure outcomes of nursing care over time and across the continuum of care in diverse settings.

The Health Status Outcomes Dimensions⁶ (HSOD) instrument was developed by the KPNCR Outcomes Taskforce for the monitoring of health related outcomes sensitive to nursing intervention and care. The HSOD was developed to support both the concurrent delivery of care, the retrospective analysis of care provided as well as the prospective planning of future care systems and models. In combination with the current NUD, comprehensive discussions of best practice (as defined by quality, cost and the impact of the health status of our members) could take place.

After an extensive review of the literature, it was determined that there were no published instruments which met all of the following requirements: 1) health focused; 2) reflected the scope of independent nursing practice; 3) easily incorporated into routine care activities and documentation; 4) supported the planning of care for the current health care event; 5) provided a baseline from which the patient's current status could be evaluated and from which the potential outcome for the patient could be projected; 6) a generic instrument which could provide consistent data across both settings of care and across diverse patient populations; 7) established reliability and validity and 8) complimented existing quality and data base efforts within the KPNCR. As the Quality Audit Marker for HIV⁷ (QAM) came closest to meeting the criteria, the Outcomes Taskforce decided to refine and expand this existing instrument.

Domains of care reflected in the HSOD instrument include functional status, knowledge and engagement in care and patient/caregiver/family psychosocial well-being. While historically, nursing practice has centered on maximizing client health in these areas,^{8,9} it was important to establish that nursing in the HMO structure also believed it impacted these outcomes. The original QAM had demonstrated validity and reliability in the HIV/AIDS¹⁰ and hip and knee replacement populations.¹¹ The instrument required retesting in the KPNCR as additional health related measures had been added to the QAM and because it would be used to evaluate outcomes across all patient populations and in multiple settings (hospital, medical office and home).

CONTENT VALIDITY OF THE HSOD

Methods

Nurses representing hospital, medical office and home care nursing as well as the major nursing specialties participated in the instrument development process and provided feedback from their peers. For this reason, the Outcomes Taskforce had a fair degree of confidence that the content validity of the HSOD would prove to be valid across setting and specialties of care. To test this

assumption, it was decided to conduct a survey of nurses within KPNCR.

A computer generated random sample of 1900 nurses was surveyed representing approximately 20% of all positions requiring licensure as a registered nurse. Nurses complete five point Likert type scales anchored on one end with "1 - none at all" and on the opposite end with "5-strongly." The nurses responded to the stem question "How much does independent nursing assessment and intervention impact patient outcomes in this area of care?" Each of the fourteen care elements within the three domains were addressed.

Results

A total of 538 (28.3%) surveys were completed. The respondents were mainly staff nurses (85%) and represented a wide selection of both inpatient and outpatient clinical specialties. The majority of the sample held a bachelors of science or higher degree in nursing. The mean years of experience in nursing was 16.8 with an average of 9.2 years of experience in KPNCR.

Table 3. RN Rating of Independent Nursing Assessment and Intervention on Item by Domain

Domain/Item	Mean	SD
Functional Status		
Bathing	3.3	1.1
Grooming	3.2	1.1
Dressing	3.2	1.1
Toileting	3.6	1.1
Physical Performance	3.8	0.9
Ambulation	3.8	0.9
Health Care Engagement		
Knowledge	4.7	0.6
Involvement in Care	4.5	0.7
Mental and Social Well-being		
Fear	4.5	0.7
Anxiety	4.5	0.7
Individual Coping	4.5	0.7
Altered Role Performance	4.1	0.9
Family/Caregiver Role Strain	4.2	0.9
Family Coping	4.4	0.8

SD - Standard Deviation

The mean scores for elements within functional status ranged from 3.2 to 3.8. In contrast, health care engagement ranged from 4.5 to 4.7, and mental and social well-being from 4.1 to 4.5. The results indicate that KPNCR nurses believe their interventions have a

moderate influence on outcomes related to functional status. The results also indicate the nurses believe they have a strong impact on the knowledge, engagement in care and psychosocial well-being of KPNCR members.

It is hoped that the proposed data base structure will provide the information needed to tease out and quantify the impact and quality of nursing care within the three domains. By capturing the patients health status on admission and discharge into each of the arenas of nursing care (hospital, medical office, home) the relationship between practice and the trajectory or pattern of the patient's return to health can be evaluated. Practice patterns which maximize the return to health over the shortest time frame and for the least cost would be identified as best practices. To accomplish these goals however, the construct and criterion validity and the interrater and intrarater reliability of the instrument in practice must be established. This research is scheduled for completion in 1995.

CONCLUSIONS

Database development within an HMO is a complex process. The process of ensuring valid, reliable and comparable data from each unit within sixteen medical centers is challenging. A total of seven years elapsed from the decision to implement systems to the production of the first NUD and Successful Practice reports. During that time, many lessons were learned in relation to the need for autonomy versus standardization, the perils of both over and under standardization, the need for effective data quality systems and reports and the importance of a partnership between the producers and users of the data. Above all, the absolute commitment to the maintenance and support of the systems and their supporting standards must exist at all levels of the organization.

Research testing the validity and reliability of the HSOD is currently in process. Next steps include: 1) defining the common nomenclatures to be used within nursing; 2) creating the mainframe structure to support the collection of the HSOD data and 3) the collection of HSOD data for one year within three facilities to test the ability of the complete infrastructure to differentiate and evaluate nursing practice through health related outcomes. Given this is successful, it will be possible to effectively evaluate practice through the perspective of the best outcomes at the lowest cost.

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References

1. Bond S, Thomas LH. Issues in measuring outcomes of nursing. *Journal of Advanced Nursing*. 1991; 16: 1492-1502.
2. Jones K. Outcomes analysis: Methods and issues. *Nursing Economics*. 1993; 11:141-151.
3. Relman AS. Assessment and accountability. The third revolution in medical care. *New England Journal of Medicine*. 1988; 319:220-22.
4. Dixon & Massey. *Introduction to Statistical Analysis*, 3rd ed. :184.
5. Leary R, Leary R, Dove H. Research review: Refined diagnosis-related groups -- A new perspective on patient classification. *Topics in Health Information Management*. 1993; 14:77-87.
6. Crawford BL, Taylor LS, Seipert BS, Lush MT. The imperative of outcomes analysis: An integration of traditional and nontraditional outcome measures. Accepted for publication *Journal of Nursing Quality*, 1996.
7. Holzemer WL, Henry SB, Stewart A, Janson-Bjerklie S. The Quality Audit Marker: An outcome measure for hospitalized HIV/AIDS patients. *Quality of Life Research*. 1993; 7:99-107.
8. Cherkin D. Methods and measurement in patient outcomes research: Universal issues. *Patient Outcomes Research: Examining the Effectiveness of Nursing Practice*. Department of Health and Human Services, Bethesda MD: NIH. 1992.
9. Murdaugh C.. Quality of life, functional status, patient satisfaction. *Patient Outcomes Research: Examining the Effectiveness of Nursing Practice*. Department of Health and Human Services, Bethesda MD: National Institutes of Health. 1992.
10. Holzemer WL, Janson-Bjerklie S, Brown DS, Henry SB. The Quality Audit Marker: A measure of outcomes of nursing care. *Communicating Nursing Research*. 1991; 24:201.
11. Ireson CL. Psychometric analysis of the Quality Audit Marker in patients undergoing total joint replacements. Unpublished manuscript, University of Kentucky. 1993.